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FISHES OF THE SCORPIONFISH SUBFAMILY CHORIDACTYLINAE
FROM THE WESTERN PACIFIC AND THE INDIAN OCEAN

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ABSTRACT: The Indo-West Pacific scorpionfish subfamily Choridactylinae Kaup contains two genera and 10 species. The subfamily synonyms include Pelorinae Gill and Inimicinae Gill, the latter being the subfamily name applied to this group until now. Two species, with three free lower pectoral rays, are placed in the genus *Choridactylus* Richardson, which includes the nominal genera *Chorismodactylus* Günther and *Choridactylodes* Gilchrist. Eight species, with two free lower pectoral rays, are included in *Inimicus* Jordan and Starks; *Pelor* Cuvier, *Simopias* Gill, and *Chorismopelor* Chevey are synonyms of *Inimicus*. Three species groups are recognized in *Inimicus*: (1) *I. filamentosus* (Cuvier); (2) *I. caledonicus* (Sauvage), *I. cuvieri* (Gray), *I. didactylus* (Pallas), and *I. sinensis* (Valenciennes); (3) *I. brachyrhynchus* (Bleeker), *I. japonicus* (Cuvier), and *I. joubini* (Chevey). Nine other nominal species are recognized as synonyms, including *I. bifilis* Fowler and *I. cirrhosus* McKay. Salient features used in the descriptions of species and separation of species groups include fin-ray counts, elevation of the orbits, head shape, height of interspinous membranes, and color pattern on the inside of the pectoral fin. Descriptions and figures are provided for all species.

The subfamily is distributed throughout the Indian Ocean and the western Pacific to Japan, the major islands of the Indo-Australian Archipelago to tropical Australia, and east to Melanesia. The species are bottom-dwelling fishes of silty and sandy substrates. They are nearshore or slightly offshore forms, most occurring shallower than 40 m.

Certain morphological and behavioral features allow burying in the substrate, and these features are discussed and illustrated based on aquarium observations.

INTRODUCTION

Scorpionfishes of the subfamily Choridactylinae occur in the Indo-West Pacific faunal region

and are characterized by having the lower two or three pectoral fin rays free. These rays are used in certain forms of locomotion, and their morphology has been discussed by Samuel (1961). Matsubara (1943) defined the subfamily (as Pelorinae) on an osteological basis, including

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in the subfamily only the genus *Inimicus*. We refer to this subfamily the genera *Choridactylus*, *Chorismopelor*, and *Simopias*, the latter two being synonymous with *Inimicus*. These genera were often placed in the family Synanceiidae by previous workers (Bleeker 1874, "Synanceioidei"; Herre 1951, "Synanceiidae"; Smith 1958, "Synanciidae"; de Beaufort 1962, "Synanceidae"). Reasons for recognizing the Choridactylinae [formerly Inimicinae], Minoinae, and Synanceinae as subfamilies of the Scorpaenidae are provided by Eschmeyer and Rama-Rao (1973).

This paper is one of a continuing series devoted to defining the species of the family Scorpaenidae and their allies. The species of the subfamily Choridactylinae are poorly known and no revision of the group is available. Earlier studies (e.g., Jordan and Starks 1904; Matsubara 1943; Herre 1951; Smith 1958; de Beaufort in Weber and de Beaufort 1962) were of a regional nature, although McKay (1964), in describing a new species of the genus *Inimicus*, provides a brief discussion of most of the nominal species of the genus, as does Condé (1977). Condé also includes excellent color photographs of *I. filamentosus* and behavioral observations.

The limited information available on the ecology of these fishes seems to indicate that they are bottom-dwelling, marine forms which tend to inhabit open sandy or silty substrates (McKay 1964). The group is largely a coastal one, with a shallow bathymetric distribution. Most specimens have been collected in less than 40 m and some occur to about 90 m; at least some have been taken from near estuaries, but no salinity information is available. The species are venomous, as are apparently all scorpionfishes. An account of a sting is given by McKay (1964) for one species. Our observations on stomach contents of some species of *Inimicus* show they feed mainly on small fishes. These species lack a gas bladder and apparently sit quietly camouflaged on the bottom waiting for prey to approach (Weber 1913; McKay 1964; Condé 1977).

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METHODS

Methods of measuring and counting follow Eschmeyer (1969). Pectoral fin length is measured from the base of the first ray to the tip of the posteriormost ray; in those species of *Inimicus* which have the upper one or two rays long and filamentous, the filaments are not measured as part of the pectoral fin length. In fishes of the subfamily Choridactylinae, the last soft ray of the dorsal and anal fins is separate, with

its own support, and widely spaced from the preceding ray.

Abbreviations of depositories other than those listed in the Acknowledgments are: SU—Stanford University, now housed at the California Academy of Sciences (CAS), ZSI—Zoological Survey of India, Calcutta, HUI—Hebrew University, Jerusalem, QMB—Queensland Museum, Brisbane.

SUBFAMILY CHORIDACTYLINAE KAUP

Choridactylinae KAUP, 1858:332 (as a subfamily of Triglidae).
GILL 1888:569 (compiled from Kaup).
Pelorinae GILL, 1893:135 (as a subfamily of Synanceidae).
JORDAN AND STARKS 1904:93, 158 (as a subfamily of Scorpaenidae). MATSUBARA 1943:413–414 (defined on internal features, *Inimicus* only, as a subfamily of Scorpaenidae).
Inimicinae GILL, 1905:224 (Pelorinae in synonymy; genera).
FOWLER 1938a:51 (in key). ESCHMEYER AND RAMA-RAO 1973:339 (characterization; included genera).

The subfamily name Choridactylinae apparently has not been used since it was proposed in 1858, except that Gill (1888) quoted Kaup's use of the name. The subfamily name Inimicinae has received only limited usage. We do not feel the use of Choridactylinae will upset a long-established name or cause confusion. Pelorinae cannot be used since *Pelor* is a junior homonym (see *Inimicus* below).

SUBFAMILY DIAGNOSIS.—Body and head without scales; except lateral line scales buried, widely spaced, about 13–15 in number; plus additional buried scales (usually appearing as warts or tufted lumps) between lateral line and dorsal fin base. Dorsal spines 12–18, dorsal soft rays 5–10, total spines plus rays 21–27. Anal spines always 2, soft rays 8–13. Pectoral fin rays 12, lowermost 2 (*Inimicus*) or 3 (*Choridactylus*) entirely free. Pelvic fin with 1 spine and 5 soft rays. Most soft fin rays branched. Second suborbital (third infraorbital) bone becoming wider posteriorly, and attaching to preopercle; with 2 main ridges, one pointing up to third suborbital bone, one pointing back; fourth suborbital bone absent or fused with third. Vertebrae 26–30.

Key to the Genera and Species of the Subfamily Choridactylinae

- 1a. Dorsal spines 12–15; 3 lower pectoral rays free and detached from remainder of fin
----- *Choridactylus* 2
- 1b. Dorsal spines 15–18; 2 lower pectoral rays free and detached from remainder of fin
----- *Inimicus* 3

- 2a. Dorsal spines 12–14, usually 13; total anal fin spines plus soft rays 10–11, usually 10; pectoral fin without filamentous rays; inner pectoral coloration as in Figure 1a
----- *Choridactylus multibarbus* (Fig. 2a)
- 2b. Dorsal spines 13–15, usually 14; total anal fin spines plus soft rays 10–12, usually 11; pectoral fin with first ray ending in a long filament; inner pectoral coloration as in Figure 1b
----- *Choridactylus natalensis* (Fig. 2b)
- 3a. Dorsal spines from fourth to last mostly free from interspinous membrane; snout usually longer than postorbital distance (postorbital distance into snout 0.9–1.7)
----- 4
- 3b. Dorsal spines from fourth to last well connected by interspinous membrane up to midheight of spines; snout shorter than postorbital distance (postorbital distance into snout 0.7–0.9)
----- 7
- 4a. Upper two pectoral rays filamentous in juveniles and adults; orbits extremely elevated, close-set, and broadly joined at their bases; interorbital space about equal to orbit diameter; inner pectoral fin coloration as in Figure 1c
----- *Inimicus filamentosus* (Fig. 3a)
- 4b. Upper two pectoral rays not filamentous in specimens over about 50 mm SL; orbits little elevated, widely spaced at their bases and joined only by a low ridge of bone; interorbital space wide, usually greater than 1½ times orbit diameter; inner pectoral fin coloration not as in Figure 1c
----- 5
- 5a. Inner pectoral fin coloration uniform gray, without any markings, as in Figure 1d
----- *Inimicus cuvieri* (Fig. 3b)
- 5b. Inner pectoral fin coloration not plain colored
----- 6
- 6a. (3 choices) Inner pectoral fin with pale spots of irregular size on a dark background as in Figures 1e–f
----- *Inimicus sinensis* (Fig. 3c)
- 6b. Inner pectoral fin with two dark areas alternating with white as in Figures 1g–h
----- *Inimicus caledonicus* (Fig. 4)
- 6c. Inner pectoral fin coloration as in Figures 1i–l
----- *Inimicus didactylus* (Figs. 5, 9–10)
- 7a. Inner pectoral fin dusky, with black spots, and a transverse white band in middle of

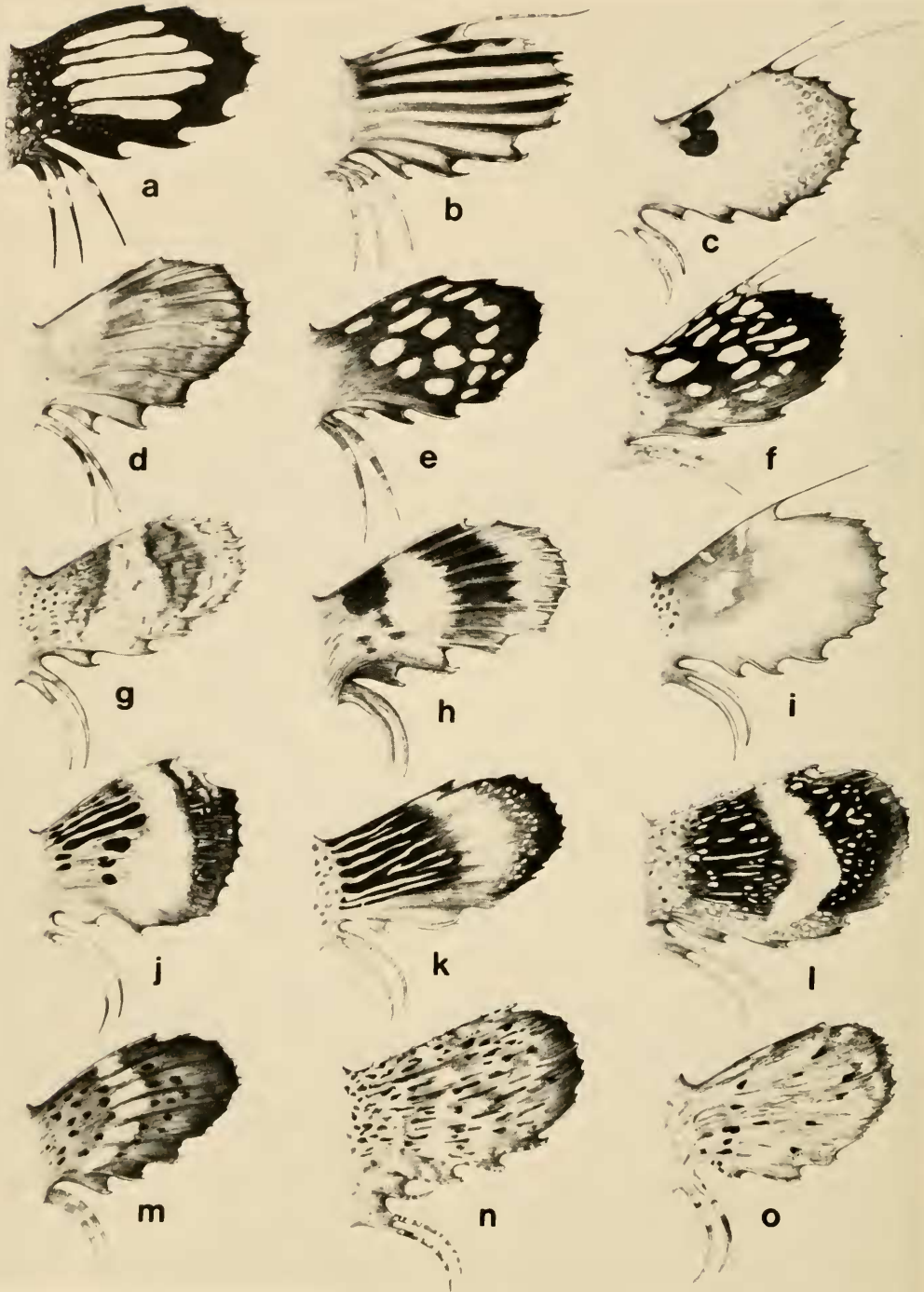


FIGURE 1. Coloration on inner surface of right pectoral fin in species of *Choridactylus* and *Inimicus*. (a) *C. multibarbus*, CAS 15069, 89.5 mm SL; (b) *C. natalensis*, CAS 31463, 70.3 mm; (c) *I. filamentosus*, MNHN A998, 178 mm; (d) *I. cuvieri*, CAS 13536, 130 mm; (e) *I. sinensis*, USNM 218534 122 mm; (f) *I. sinensis*, WAM P4989, 55 mm (note filament in this juvenile); (g) *I. caledonicus*, based on MNHN A2498, 91.2 mm and 96.3 mm; (h) *I. caledonicus*, SU 20555, 170 mm; (i) *I. didactylus*, USNM 168173, 29.4 mm, juvenile; (j) *I. didactylus*, USNM 136458, 79.8 mm; (k) *I. didactylus*, USNM 218504, 132 mm; (l) *I. didactylus*,

fin as in Figure 1m.....

..... *Inimicus brachyrhynchus* (Fig. 6)

7b. Inner pectoral fin coloration not as above, dusky to blackish, often with brown or black spots or streaks as in Figures 1n-o.....

8

8a. Third pectoral ray from bottom free for about 1/3 its length as in Figure 1n.....

..... *Inimicus joubini* (Fig. 7a)

8b. Third pectoral ray from bottom not free, except just at tip as in Figure 1o.....

..... *Inimicus japonicus* (Fig. 7b)

Genus *Choridactylus* Richardson

Choridactylus RICHARDSON, 1848:8-10, pl. 2, figs. 1-3 (type-species *Choridactylus multibarbus* Richardson, 1848, by monotypy).

Chorismodactylus: GÜNTHER 1860:151 ("unjustified emendation" for *Choridactylus* Richardson).

Choridactylodes GILCHRIST, 1902:101 (type-species *Choridactylodes natalensis* Gilchrist, by monotypy; differed from *Choridactylus* in having usually one more dorsal spine and a hairlike prolongation of the uppermost pectoral ray).

Following earlier authors, we recognize two species in the genus *Choridactylus*, and we do not feel that the small differences between them warrant two genera. *Choridactylus natalensis* is restricted to the southeast coast of Africa, and *C. multibarbus* occurs from the Red Sea east to China and the Philippines (see Fig. 8).

DIAGNOSIS.—Dorsal XII-XV, 8-10, total 21-24. Anal II, 8-10. Pectoral 12, with 3 lower rays free. Vertebrae 26-28. Head small, eyes slightly elevated, with depressed area at occiput extending across nape and behind eyes. Head blunt in front, snout not much longer than orbit. Interorbital space wide, about equal to 1.5 times orbit diameter, with a median depressed area. Mouth small, slightly oblique. Villiform teeth on jaws, none on vomer and palatines. Small tentacles or skin flaps present on head and body, especially on lower jaw, eye, spinous dorsal and pectoral fins, and as tufts on lateral line scales and above lateral line.

SPINATION.—Head shape and spination virtually the same for both species. Most head spines developed as lumps. Lachrymal bone with two spines over maxillary, first small, pointing out and forward, second very long and directed backward, extending past jaw to below

eye. Two ridges or spines present on lateral face of lachrymal bone; suborbital spines poorly developed, usually one short ridge or lumps followed by second longer ridge. First two preopercular spines well developed; first very long, with a small supplemental spine usually present at its base, second moderate, third through fifth small to virtually absent. Nasal spines absent. Preocular spines broad, followed by three or four small lumps over eye at position of supraocular and postocular spine. Tympanic spines absent. Parietal and nuchal spines present, joined; sometimes as three lumps. Pterotic spine small. Sphenotic spine absent. Posttemporal bone with a long, blunt spine and with a ridge or spine present at anteroventral base. Supracleithral spine small, obscured by skin. Cleithral spine present, blunt. Opercular bone with two poorly defined ridges.

Choridactylus multibarbus Richardson

(Figures 1a, 2a, 8; Table 1)

Choridactylus multibarbus RICHARDSON, 1848:8-10, pl. 2, figs. 1-3 (original description; type-locality Sea of China).

Apistus niger: JERDON 1851:141 (listed; Madras, India).

Choridactylus multibarbus: DAY 1875:161-162, pl. 39, fig. 2 (description; referred Jerdon's identification of *Apistus niger* to this species; common at Madras). DAY 1889:74, fig. 32 (description; figure from Day 1875). TORTONESE 1934:227 (description; Massaua, Red Sea). ?BORODIN 1932:89-90 (venom properties and fear by natives; Raitea, Society Is. [see Remarks below]). TORTONESE 1937:205 (Red Sea, one specimen from Massaua; short description). ?FOWLER 1938b:290 (listed; Society Is.; from Borodin 1932). BLEGVAD 1944:192-193 (listed from Iranian Gulf). HERRE AND HERALD 1950:89-90 (Philippines; good figure; two from Manila Bay in 13-15 fms). HERRE 1951:466-488 (brief synonymy; range; description of Philippine specimens). MUNRO 1955:250 (description; Gulf of Manaar). SMITH 1958:176, pl. 7, fig. J (compiled; figure from Richardson 1848; incorrectly cited Mauritius instead of coast of Arabia for Steindachner 1907). SAMUEL 1961:79-83 ("walking" mechanism; description and osteology of pectoral girdle). SMITH AND SMITH 1963:54, pl. 51J (expected at Seychelles; figure from Richardson 1848). AHMED AND QURESHI 1970:205, text-fig. (description; coastal waters and tidal inlets of Pakistan).

Chorismodactylus multibarbus: GÜNTHER 1860:151-152 (incorrect subsequent spelling of *Choridactylus multibarbus*; brief description; China, and Madras, India). BOULENGER 1889:239 (listed; Muscat, east coast of Arabia). STEINDACHNER 1907:163 (listed; east coast of Arabia).

Chorismodactylus multibarbus: BLEEKER 1873:141 (listed from China, "*=Choridactylus multibarbus*").

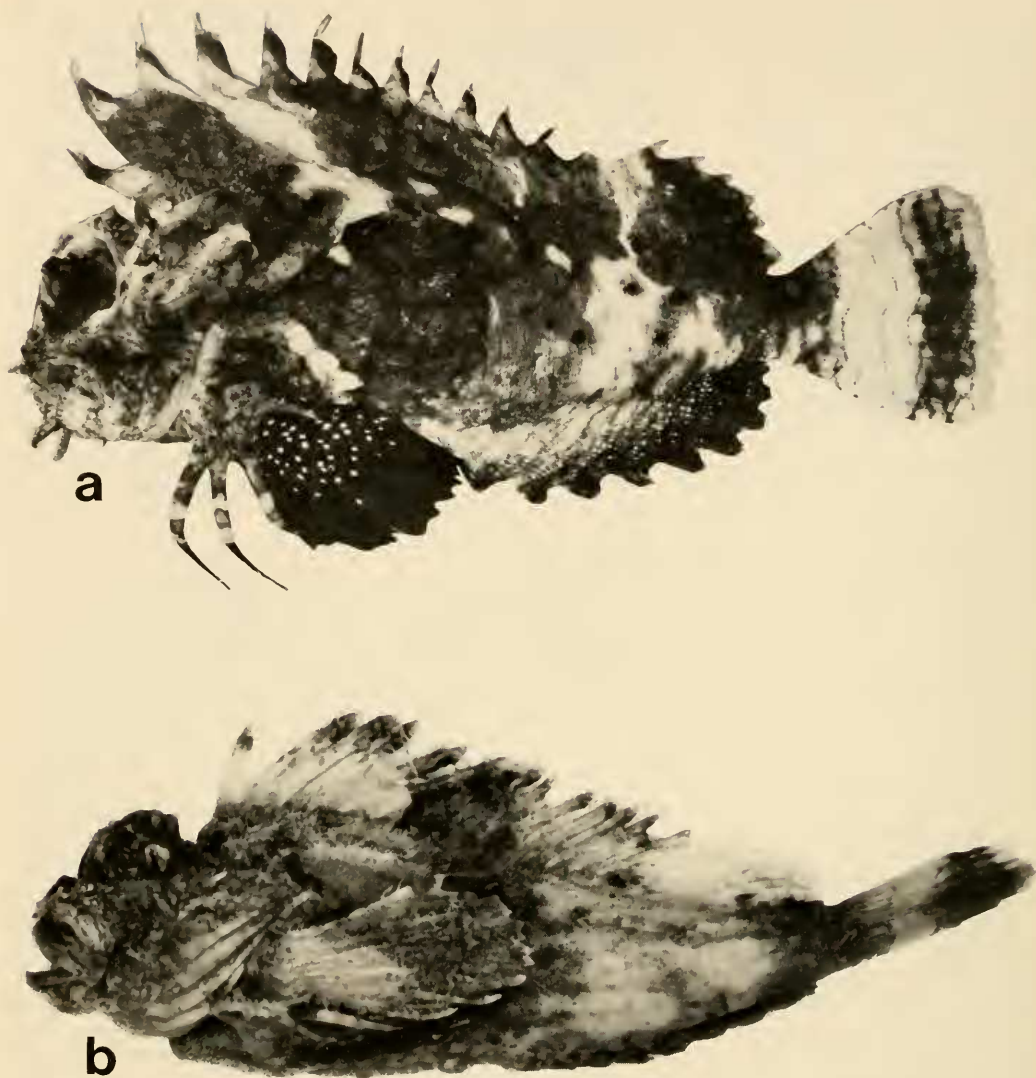


FIGURE 2. (a) *Choridactylus multibarbus*, BPBM uncat., 83 mm SL, Madras, India (photo by J. Randall of a fresh specimen); (b) *C. natalensis*, BMNH 1901.9.24.2, 59.8 mm, syntype, Natal, South Africa.

REMARKS.—Borodin (1932) identified *Choridactylus multibarbus* from the Society Islands, and Fowler subsequently (1938b) listed this species from there. It is unlikely that *C. multibarbus* occurs there as the genus is not otherwise known from Oceania. The fear by the natives and capture by spearing suggests a stonefish (*Synanceia*).

Günther (1860) seems to have been the first to misspell the genus and species name (as *Chorismodactylus multibarbis*), and most subsequent workers have wrongly followed him. The original correct spelling is *Choridactylus multibarbus*.

MATERIAL EXAMINED.—**Persian Gulf:** BPBM 21081 (1, 87).
Southeast coast of India: ANSP 77541 (1, 57.8). MNHN 02—

TABLE 1. DORSAL AND ANAL FIN RAY COUNTS IN SPECIES OF THE GENERA *Choridactylus* AND *Inimicus*.

Species	Dorsal Spines								Dorsal Soft Rays								\bar{x}
	XII	XIII	XIV	XV	XVI	XVII	XVIII	\bar{x}	5	6	7	8	9	10			
<i>C. multibarbus</i>	1	13	2	—	—	—	—	13.06	—	—	—	1	15	—	8.94		
<i>C. natalensis</i>	—	1	6	1	—	—	—	14.00	—	—	—	5	2	1	8.50		
<i>I. filamentosus</i>	—	—	—	4	1	—	—	15.20	—	—	1	4	—	—	7.80		
<i>I. cuvieri</i>	—	—	—	—	—	32	20	17.38	—	—	—	26	26	—	8.50		
<i>I. sinensis</i>	—	—	—	—	—	17	9	17.35	—	—	1	13	12	—	8.42		
<i>I. caledonicus</i>	—	—	—	—	—	9	—	17.00	—	—	—	7	2	—	8.22		
<i>I. didactylus</i>	—	—	—	2	35	2	—	16.00	—	—	3	23	13	—	8.26		
<i>I. brachyrhynchus</i>	—	—	—	—	—	2	—	17.00	—	—	—	2	—	—	8.00		
<i>I. joubini</i>	—	—	—	—	—	2	—	17.00	—	—	2	—	—	—	7.00		
<i>I. japonicus</i>	—	—	—	—	5	37	4	16.98	1	7	33	5	—	—	6.91		

Species	Total Dorsal Spines and Rays										Total Anal Spines and Rays										\bar{x}
	21	22	23	24	25	26	27	\bar{x}	10	11	12	13	14	15							
<i>C. multibarbus</i>	1	14	1	—	—	—	—	22.00	15	1	—	—	—	—	10.06						
<i>C. natalensis</i>	1	3	3	1	—	—	—	22.50	1	6	1	—	—	—	11.00						
<i>I. filamentosus</i>	—	—	5	—	—	—	—	23.00	—	1	3	—	—	—	11.75						
<i>I. cuvieri</i>	—	—	—	—	7	44	1	25.88	—	—	—	3	41	7	14.08						
<i>I. sinensis</i>	—	—	—	—	6	20	—	25.77	—	—	—	2	22	2	14.00						
<i>I. caledonicus</i>	—	—	—	—	7	2	—	25.22	—	—	—	5	3	—	13.38						
<i>I. didactylus</i>	—	—	5	20	13	1	—	24.26	—	—	4	32	3	—	12.97						
<i>I. brachyrhynchus</i>	—	—	—	—	2	—	—	25.00	—	—	2	—	—	—	12.00						
<i>I. joubini</i>	—	—	—	2	—	—	—	24.00	1	1	—	—	—	—	10.50						
<i>I. japonicus</i>	—	—	9	34	3	—	—	23.87	1	32	12	—	—	—	11.23						

196 (1, 59.6). SU 14665 (4, 53.9–81.6). CAS 31462 (1, 71.2). CAS 33951 (2, 58.0–71.5).

Gulf of Thailand: CAS 15066 (1, 76.1). CAS 15067 (1, 73.3). CAS 15068 (1, 84.3). CAS 15069 (1, 89.5). CAS 15070 (1, 96.0). CAS 15071 (1, 76.2, cleared and stained). CAS 15072 (1, 98.5).

China: BMNH uncat. (51.0, dried, holotype of *Choridactylus multibarbus*), "Samarang," J. Richardson.

Philippines: UWCF 10164 (1, 51.4).

DIAGNOSIS.—First pectoral ray not filamentous in adults; inside of pectoral fin with about 5 oblong white areas, surrounded by black or brown pigment and usually with white specks in axil (Fig. 1a).

DESCRIPTION.—Dorsal fin with 12–14 (usually 13) spines and 8–9 (usually 9) soft rays, total 21–23 (usually 22). Anal fin with 2 spines and 8–9 (usually 8) soft rays. Pectoral fin with 12 rays, lower 3 rays free, rays 2 through 6 or 7 usually branched in adults. Gill rakers on outside of first arch total 9–11, 2–3 on upper arch, 7–9 on lower arch. Buried lateral line scales about 13–15, including one on caudal fin. Vertebrae 26 (9 specimens). Head spines and head shape as for the genus.

Coloration in life as given by Day (1875:161; 1889:74) for a specimen from India: "brownish, with a yellow shoulder mark, and two or three vertical orange bands: base of ventral and anal with fine white spots. Fins blackish brown, with a light band between the fourth and sixth dorsal spines: margins of pectorals orange: caudal with a black band at its base, and another in its last third having a light edge: outer two-thirds of anal blackish: free rays black, with white in the middle."

General body shape and coloration in preservative as in Figure 2a. Color variable; head and body mostly brown or dark gray, with pale areas; sometimes irregular dark spots on sides. Dorsal fin usually paler at front, at about spines 3–5, and at front of soft dorsal fin; pale areas usually extending on to body. Caudal fin pale at middle (sometimes crossed by narrow vertical wavy lines), broadly dark on posterior half, with tips of rays pale. Anal and pelvic fins dark, with many small pale spots at base and on adjacent parts of body. Inner surface of pectoral fin as in Figure 1a; outer surface of pectoral fin mostly dark, with paler areas showing through faintly from inner side of fin.

Measurements for three specimens (51.4–75.4 mm SL) in percent SL: head 35–36, snout 11–14, orbit 9–11, interorbital width 11–12, postorbital 15–17, pectoral 37–39.

COMPARISONS.—The two species of *Choridactylus* can be separated from all other scorpaenids by the combination of three free pectoral fin rays and no scales on the body. *Choridactylus multibarbus* differs from *C. natalensis* by lacking the elongated filamentous first pectoral ray (although small specimens of *multibarbus* may have a slight elongation of this ray), having one less vertebra (26 versus 27), and in having a different coloration on the inside of the pectoral fins (Fig. 1a versus 1b). *Choridactylus multibarbus* averages about one fewer dorsal spines, one more dorsal soft ray, and one less anal soft ray than *C. natalensis*.

DISTRIBUTION.—*Choridactylus multibarbus* is known from the Red Sea, Persian Gulf, Gulf of Oman, Pakistan, India, Gulf of Thailand, China, and the Philippines. It is known from sand or mud bottoms in depths from near shore to 40 m.

Choridactylus natalensis (Gilchrist)

(Figures 1b, 2b, 8; Table 1)

Choridactylodes natalensis GILCHRIST, 1902:101–103, pl. V, figs. 1 and 2 (original description; as type of a new genus; two specimens from 2½ miles [4 km] off Umhlanga River mouth, in 22–26 fms [40–48 m], bottom of fine sand, 25 Mar. 1901; and five specimens from off Cape Natal Lighthouse, in 22 fms [40 m], bottom of fine sand). GILCHRIST AND THOMPSON 1917:410 (listed, Natal). VON BONDE 1924:3, 30 (specimens from SE coast of Africa, PICKLE stations 169, 190, and 193, depths 27–29 fms [49–53 m]). FOWLER 1925:254 (brief description; Durban Bay [ANSP 86316]). FOWLER 1934:485 (listed from Durban and Natal [ANSP 87807, 86316, 88020]). SMITH 1949:375, pl. 83 (brief description; Natal; color fig.).

Choridactylus natalensis: BARNARD 1927:922, pl. XXXIII (description; synonymy; figure from Gilchrist 1902). BARNARD 1947:199, pl. 24, fig. 2 (compiled). SMITH 1958:176–177, pl. 8, fig. B (description; coloration; two specimens from 20 fms [37 m], off Natal; good photograph). SMITH AND SMITH 1963:54, pl. 52, fig. B (expected at Seychelles; figure from Smith 1958).

MATERIAL EXAMINED.—All specimens from the SE coast of Africa: BMNH 1901.9.24.2 (60.0, syntype of *C. natalensis*) 3 miles [4.8 km] off Natal coast, collected by J. D. F. Gilchrist. ANSP 86316 (1, 108). ANSP 87807 (1, 103). ANSP 88020 (1, 63.5). RUSI 2000 (2, 65.5–67.0). RUSI 2001 (1, 80.2). CAS 31463 (1, 70.3).

DIAGNOSIS.—First pectoral ray terminating in a long filament, extending well beyond margin of fin; inside of pectoral fin with dark stripes (over rays) on a pale background (Fig. 1b).

DESCRIPTION.—Dorsal fin with 13–15 (usually 14) spines and 8–10 (usually 8 or 9) soft rays, total 21–24 (usually 22–23). Anal fin with 2

spines and 8–10 (usually 9) soft rays. Pectoral fin with 12 rays, lower 3 rays free, rays 2–5 branched in available material. Gill rakers on outside of first arch total 8–10, 1–3 on upper arch, 6–8 on lower arch. Buried lateral line scales 13–14, including one on caudal fin. Vertebrae 27 (3 specimens) or 28 (1). Head spines and head shape as for the genus.

Coloration in life as given by Smith (1958:177): "Colour variable, brilliant, mottled, spotted and marbled in brown, pink and yellow. Front of body rather darker, several vague bars on hinder part extending onto dorsal and anal. Base and distal 3rd of caudal dark, mid posterior and hind margin pink. Lower free pectoral rays annulate pink."

General body shape and coloration in preservative as in Figure 2b. Color variable; body and head mostly brown, mottled, sometimes with darker brown spots on side of body. Dorsal fin brown, paler at level of spines 4–6, 11–12, and on anterior half of soft dorsal fin. Caudal fin pale in middle, a broad dark band on posterior half, with tips of rays or distal edge of fin pale. Anal fin brown, usually mottled with lighter pigment. Pelvic fins mostly dark brown, often with minute pale dots at base and on adjacent part of body. Inner surface of pectoral fin with dark bars overlying the rays (Fig. 1b); outer surface of pectoral fin brown or tan, mottled with darker and lighter areas.

Measurements for four specimens (65.5–103 mm SL) in percent SL: head 33–35, snout 10–12, orbit 7–10, interorbital width 8–10, postorbital 15–17, pectoral fin 31–37.

COMPARISONS.—See account of *C. multibarbus* (p. 482).

DISTRIBUTION.—*Choridactylus natalensis* is known only from Durban Bay, South Africa, north to Mozambique, in depths from about 35 to 75 m on sandy bottom.

Genus *Inimicus* Jordan and Starks

Pelor CUVIER, 1829:168 (type-species *Scorpaena didactyla* Pallas, 1769, by original designation [footnote 6 on p. 168 as, "Pel. obscurum, Nob., ou *Scorpaena didactyla*, Pall., Spic. Zool. . . ."]).

Inimicus JORDAN AND STARKS, 1904:158 (type-species *Pelor japonicum* Cuvier in Cuvier and Valenciennes 1829, by original designation; wrongly thought type-species of *Pelor* was *filamentosum*). CONDÉ 1977:15–16 (species of genus). *Simopias* GILL, 1905:224 (a replacement name for *Pelor*; type-species *Scorpaena didactyla* Pallas by reason that *Simopias* was proposed as a replacement name for *Pelor* but Gill

wrongly thought *filamentosum* was the type-species of *Pelor*; *Simopias* proposed as a subgenus of *Inimicus*).

Chorismopelor CHEVEY, 1927:222 (type-species *Chorismopelor joubini* Chevey, by original designation; comparison with other genera).

REMARKS.—The generic name *Pelor* Cuvier is preoccupied by *Pelor* Dejean, 1828 [based on unpublished table of Bonelli; see Mroczkowski 1977:61], a genus of carabid beetles. Jordan and Starks (1904:158) proposed the generic name *Inimicus* to accommodate forms like *Pelor japonicum* that do not possess filamentous upper pectoral rays. They wrongly assumed the type-species of *Pelor* was *filamentosum*, the only species then known to have the upper pectoral rays filamentous; they did not propose the name *Inimicus* as a replacement name for *Pelor*, contrary to what Jordan (1917:127) would lead one to believe. The type-species of *Pelor* was established by Cuvier when he first proposed the name (1829:168) as *Scorpaena didactyla* (which Cuvier preferred to list under his own new name *obscurum*). Gill (1905:224) also wrongly assumed the type-species of *Pelor*, and hence his replacement generic name *Simopias*, was *filamentosum* as indicated by the last sentence under his treatment of *Inimicus*; and he therefore confused his subgeneric designations. His confusion over the type-species does not obviate his replacement of *Pelor* with *Simopias*. His statements, "The name *Pelor* can not be retained for this genus inasmuch as it had been appropriated, in 1813 by Bonelli" and "The name [*Simopias*] here proposed as a substitute . . ." are a definite indication that he was replacing the preoccupied *Pelor*. *Inimicus*, by reason of priority, takes precedence over *Simopias*.

Chorismopelor was proposed for the species *joubini*, which has the third pectoral ray from the bottom free for part of its length, unlike the other species that have the third ray from the bottom fully connected by membrane to the ray above it. We do not feel this species warrants a separate genus (see Species Characters below).

We recognize eight species of *Inimicus*. The genus is mostly coastal in distribution, occurring from the western Indian Ocean to Oceania (Fig. 8).

DIAGNOSIS.—Dorsal XV–XVIII, 5–9, total 23–27; first three dorsal spines fully joined by membrane, separated from rest of fin but connected by membrane to fourth spine basally; re-

maining spines long and sharp, of about uniform height (except at beginning and end), nearly free of interspinous membranes or connected to about midheight. Anal II, 8–13. Pectoral 12, lower two rays free, third from bottom free for up to one-third its length in one species. Vertebrae 27–30. Eyes elevated, partially or almost fully joined by a bony ridge, with a shallow to deep occipital depression behind. Large, round to oblong depressed area in front of each eye, separated by an elevated median ridge running from base of eyes to snout. Mouth large, upturned. Small canine teeth on jaws and vomer, no teeth on palatines. Small tentacles or skin flaps present on head and body, especially on lower jaw, eye, spinous dorsal and pectoral fins, and as tufts on lateral line scales and above lateral line.

SPINATION.—Head spines moderately developed and covered by thick skin and often fringed with cirri. Lachrymal bone with two blunt spines over maxillary, first small and pointing forward and down, second larger and pointing down and back. Suborbital ridge with 4 spinous lumps, first on lateral face of lachrymal bone, second on first suborbital (second infraorbital) bone, third and fourth as a pair (one above the other) below eye. Preocular, supraocular, and postocular spines usually poorly defined. Nasal spine small or absent. Preopercle with supplemental and first two preopercular spines well developed, third through fifth poorly developed or virtually absent. Small spine below posterior margin of orbit sometimes present. Parietal and nuchal spines small, joined, sometimes as a rough ridge. Tympanic spine absent. Pterotic spine low and blunt, just behind orbit. Upper and lower posttemporal spines well developed. Supracleithral spine shelflike. Cleithral spine virtually absent. Opercle with one broad spine.

SPECIES CHARACTERS.—Meristic characters which differ among the species include dorsal and anal fin rays and vertebrae. Number of pectoral rays and pelvic rays is the same in all species. Measurements and ratios of body parts can be used in separating some species, the most useful of which are the length of dorsal spines in relation to the height of their interspinous membranes; interorbital width in relation to orbit diameter; and snout length in relation to postorbital distance. Juveniles apparently have the upper one or two pectoral rays elongated as filaments, but these are retained only in the adults

of *I. filamentosus*. Coloration on the inner surface of the pectoral fin is very useful in species identification.

Three species groups are recognizable. *Inimicus filamentosus* is distinct in retaining in adults the condition of the upper pectoral rays elongated into filaments and in having strongly elevated, close-set, and broadly joined orbits. *Inimicus caledonicus*, *I. cuvieri*, *I. didactylus*, and *I. sinensis* exhibit similar characters by having the snout longer than or about equal to the postorbital distance; the orbits elevated but well separated and joined only by a low ridge of bone (more pronounced in *I. didactylus*); and the interspinous membranes from the fourth to the penultimate dorsal spines very low, connecting each spine to the base of its succeeding spine; and high counts of total dorsal and especially anal rays. *Inimicus brachyrhynchus*, *I. japonicus*, and *I. joubini* resemble each other by having the snout shorter than the postorbital distance; the orbits elevated but widely spaced, and joined only by a low ridge of bone, as in the previous group; the interspinous membranes between the dorsal spines extending up to about the midheight of the spines; and a low anal fin ray count. *Inimicus joubini* differs from the other two members of this third group by having the third pectoral ray from the bottom free distally for part of its length.

***Inimicus filamentosus* (Cuvier)**

(Figures 1c, 3a, 8; Table 1)

- Pelor filamentosum* CUVIER, 1829:428–434, pl. 94 (original description; type-locality Mauritius). LESSON 1831:206, pl. 21, fig. 1 (Mauritius). CUVIER 1834:285 (Mauritius; *Squilla* as food). CUVIER 1836:pl. 25, fig. 2 (figure only). CUVIER 1837: Pisces, pl. 16, fig. 1 (figure poor). KAUP 1858:334 (listed). GÜNTHER 1860:149–150 (brief description; one specimen from Mauritius). BLEEKER 1874b:87 (listed; Borbonia [Réunion], Madagascar, and Mauritius). PETERS 1876a:439 (listed; Mauritius). SAUVAGE 1878:147 (mentioned in type description of *Pelor caledonicum*). SAUVAGE 1891:517 (listed; Madagascar). JORDAN AND STARKS 1904:158 (mentioned). BLANC AND HUREAU 1968:27 (type at MNHN).
- Pelor filamentosus*: GUICHENOT 1863:24 (listed; Réunion I.). GILL 1905:224 (as type of *Simopias*).
- Pelor didactylum*: REGAN 1908:237 (misidentified; listed; Maldives, in 30 fms [55 m]).
- Inimicus filamentosus*: FOWLER 1938a:86 (briefly compared to *I. bifilis*). SMITH 1958:176, pl. 8c (synonymy; description; one specimen from Zanzibar; range). MCKAY 1964:10–11 (compared to *I. bifilis*). TORTONESE 1968:25 (Red Sea; seen in Eilat Aquarium; compiled range). CONDÉ 1977:15–18, figs. 1–4 (description; excellent color photographs; behavior and aquarium observations).

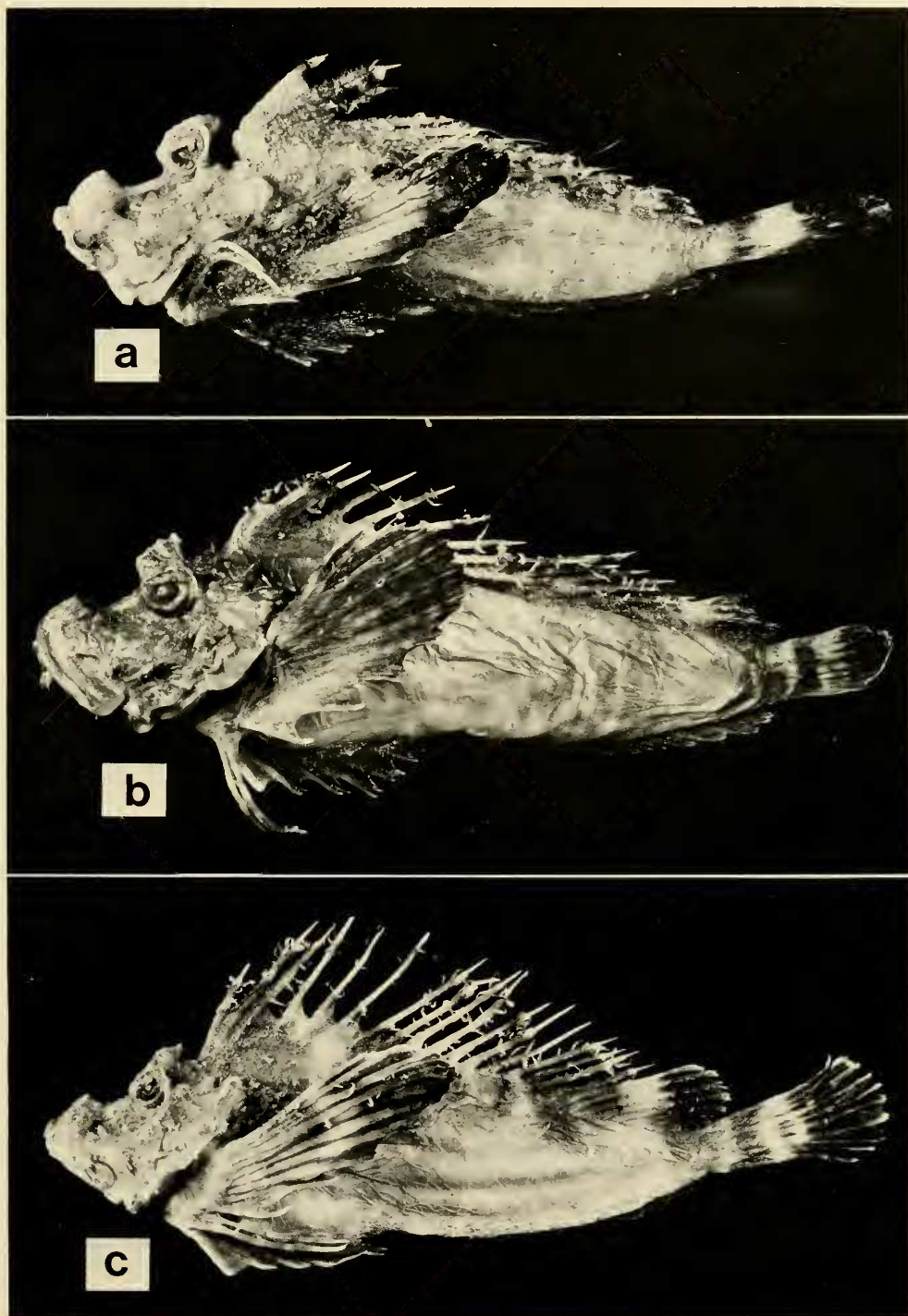


FIGURE 3. (a) *Inimicus filamentosus*, HUIJ 5261, 72 mm SL, Eilat, Red Sea; (b) *I. cuvieri*, NMS 1359, 113 mm, South China Sea; (c) *I. sinensis*, FRSHK uncat., 88.2 mm, Hong Kong.

MATERIAL EXAMINED.—**Mauritius:** MNHN 6714 (about 148, holotype of *Pelor filamentosum*), Île de France [Mauritius], collected by Lesson and Garnot, Duperrey Expedition.

Red Sea: BPBM 18283 (1, 171). HUJ-F-5261 (1, 72).

Zanzibar: RUSI 1999 (1, 122).

Malagasy [Madagascar]: MNHN A998 (1, 178).

Réunion I: MNHN 1966-854 (1, 165).

DIAGNOSIS.—Two uppermost pectoral rays elongated as filaments in specimens of all sizes; filament on second ray longer than first. Orbits extremely elevated, close-set, and broadly joined at their bases. Interorbital distance about equal to orbit diameter. A deep, oblong pit below and in front of eye. Occiput depressed, forming a deep saddle behind orbits. Snout longer than postorbital distance (postorbital into snout 1.2–1.3). Interspinous membrane from fourth dorsal spine rearwards less than one-half spine height. Inner pectoral fin coloration (Fig. 1c) diagnostic.

DESCRIPTION.—Dorsal fin with 15–16 (usually 15) spines and 7–8 (usually 8) soft rays, total 23. Anal fin with 2 spines and 9–10 (usually 10) soft rays. Gill rakers on outside of the first arch total 8–11, 3 on upper arch, 5–8 on lower arch. Vertebrae 27 (4 specimens). Head spines and general features as for the genus.

Color in life, shown in Condé (1977:15–18), mostly brown and yellow. Inner surface of pectoral fin mostly brilliant yellow, with black patches at base, brown spots subterminally, and black distally.

General body shape and coloration of preserved specimens as in Figure 3a. Body and head brown, mottled with pale areas. Large pale bars extend down on sides from dorsal fin in some specimens. Area before eyes and in occiput with large circular pale spots. Dorsal spines tipped with black or dark brown. Soft dorsal, caudal, and anal fins darker distally. Pelvic fins dark brown. Outer surface of pectoral fin brown to black surrounding a large pale area in middle. Inner surface of pectoral fin distinctively marked (Fig. 1c); upper three to five rays with black or dark brown patch just above base, sometimes as two or three roundish dark spots; distal third of fin with brown or black spots, grading into solid black or brown at edge.

Measurements for four specimens (72.2–178 mm SL) in percent SL: head 36–38, snout 18–19, orbit 6–7, interorbital width 5–9, postorbital 15–16, pectoral fin 41–50.

DISTRIBUTION.—*Inimicus filamentosus* is known from the Red Sea and the western Indian

Ocean; specific localities include Eilat, Gulf of Aqaba, Zanzibar, Malagasy Republic (Madagascar), Réunion I., Mauritius, and Maldives. Little is known of its depth distribution; one record is in 55 m, but the species probably occurs to nearshore depths, presumably on sand bottom.

Inimicus cuvieri (Gray)

(Figures 1d, 3b, 8; Table 1)

Pelor cuvieri GRAY, 1835:pl. 90, fig. 2 (drawing based on a specimen from Singapore). BLEEKER 1852a:252–253 (description; Priaman, Sumatra). BLEEKER 1854a:57 (listed; Priaman, Sumatra). GÜNTHER 1860:150 (in part, *sinense* wrongly included; brief description). BLEEKER 1861:49 (listed; Singapore). BLEEKER 1873:141 (listed; China; possibly synonymous with *P. sinense*). BLEEKER 1874a:4, 5, 8–10, pl. 2, fig. 3 and pl. 3, fig. 1 (description; good figures; Sumatra).

Inimicus cuvieri: MCKAY 1964:10–11 (brief reference to previous literature; suggestion of possible filamentous pectoral rays in juvenile *I. cuvieri*).

MATERIAL EXAMINED.—**Singapore:** BMNH uncat. (about 172, holotype of *P. cuvieri*), see Remarks below. SU 39471 (1, 53.5).

South China Sea: NMS 1358 (1, 93). NMS 1359 (1, 113).

Indonesia: NMS 738 (1, 113), Sarawak.

Gulf of Thailand: USNM 10334 (1, 195). The following were collected by the George Vanderbilt Foundation in 1960–61, most between 11°50'N and 99° to 100°E: CAS 13531 through CAS 13559 and CAS 13563 and CAS 31182, 40 specimens, 94–194 mm SL. The following were collected by F. Steiner: CAS 13560 (1, 92), CAS 13561 (3, 101–137), CAS 13562 (6, 88–153), and CAS 34299 (1, 109).

REMARKS.—The labels with the British Museum specimen indicate that it is the type and was collected by Hardwicke in India. This specimen corresponds to bottle “a” in Günther’s 1860 “Catalogue.” The type-locality given by Gray (1835) for the illustrated specimen was Singapore as published in “Illustrations of Indian Zoology.” Perhaps the locality India on the bottle label resulted from the title of the publication. To our knowledge, *I. cuvieri* does not occur off India.

DIAGNOSIS.—No filamentous pectoral fin rays in adults. Orbits only slightly elevated. Snout length usually equal to or longer than postorbital distance (postorbital distance into snout 0.9–1.3). Interspinous membrane from fourth dorsal spine rearwards less than one-fourth spine height. Inner surface of pectoral fin (Fig. 1d) without distinctive pattern, mostly solid brown, without spots.

DESCRIPTION.—Dorsal fin with 17–18 spines and 8–9 soft rays, total 25–27 (usually 26). Anal

fin with 2 spines and 11–13 (usually 12) soft rays. Gill rakers on outside of first arch total 8–11, 2–3 on upper arch, 6–8 on lower arch. Vertebrae 29 (10 specimens), or 30 (1). Head spines and general body features as for the genus. Skin on occiput and before eyes spongy, more so than in other species, thereby minimizing the apparent depth of occiput and pits before eye. Uppermost one or two pectoral rays elongated in juveniles, but not in specimens longer than about 55 mm SL.

General body shape and coloration of preserved specimens as in Figure 3b. Head and body mostly brown or gray-brown above, paler below. Some specimens with much of body pale, with dark brown on and just behind head, at middle and end of spinous dorsal fin, and below end of soft dorsal fin. Head usually with minute dark spots. Pale spot or spots present before eyes in some specimens. Soft dorsal fin usually pale anteriorly. Caudal fin mostly dark brown or black, often pale at base and at center, alternating with dark. Anal fin and pelvic fins darker distally. Inner surface of pectoral fin mostly dark brown to black, mostly plain colored, without round spots or stripes, although tiny pinpoint-sized pale spots sometimes present. Outer surface of pectoral fin brownish to blackish, sometimes with tiny brown spots and large vague pale areas.

Measurements for thirteen specimens (92.4–194 mm SL) in percent SL: head 31–40, snout 14–16, orbit 4–6, interorbital width 8–10, postorbital 12–16, pectoral fin 33–43.

COMPARISONS.—*Inimicus cuvieri* and *I. sinensis* are very similar in all features except that *I. sinensis* has large yellow spots (pale in preservative) on the inner side of the pectoral fin, while *I. cuvieri* lacks spots and has the inner surface of the pectoral fin more or less uniformly dusky.

DISTRIBUTION.—*Inimicus cuvieri* is confined to the area from the Gulf of Thailand to Sarawak, Sumatra, and Singapore. It is evidently very common in the Gulf of Thailand on sandy or mud-sand bottom. Depths of capture for the George Vanderbilt Foundation specimens were from 18 to 50 m, with one reportedly from 1 m.

Inimicus sinensis (Valenciennes)

(Figures 1e–f, 3c, 8; Table 1)

Pelorus sinense VALENCIENNES in CUVIER AND VALENCIENNES, 1833:468–469 (original description; type-locality

Canton, China [holotype MNHN 6374]). RICHARDSON 1846:212 (listed; Canton, China). GÜNTHER 1860:150 (in part; listed as possible synonym of *P. cuvieri*; China). BLEEKER 1873:141 (listed as possible synonym of *P. cuvieri*; Canton, China). SAUVAGE 1873:53, pl. 7, fig. 2 (description and figure based on type; China).

Pelorus cuvieri (not of Gray): RICHARDSON 1844:72–73, pl. XXXIX, fig. 4 (description; good figure; China); 1846:212 (brief synonymy; Canton, China).

Inimicus cuvieri (not of Gray): HERRE AND HERALD 1950:355 (listed; Philippines). FOWLER 1931:305 (Hong Kong); 1938d:30 (listed; Hong Kong).

Inimicus cirrhosus MCKAY, 1964:8–12, fig. 1 (original description; type-locality Shark Bay, Western Australia).

Inimicus sinense: RAMA-RAO AND BADRUDEEN 1973:418–421, fig. 1 (synonymy; description; Ceylon and SE coast of India).

MATERIAL EXAMINED.—Ceylon: USNM 218534 (1, 122).

Java: CAS 36066 (2, 60–61). MCZ 1097 (1, 140), ZMK P-791105 (1, 55.8).

Viet Nam: CAS 31423 (1, 83.8).

Hong Kong: CAS 31422 (1, 144). ANSP 76624 (1, 136). ANSP 76707 (1, 153). FRSHK uncat. (1, 88.2). FRSHK uncat. (1, 130). SU 60861 (1, 216). SU 61097 (1, 142).

Taiwan: CAS 15614 (1, 141).

China: MNHN 6374 (124, holotype of *P. sinense*). CAS 27662 (1, 115).

Philippine Is.: ANSP 48776 (1, 134). BPBM 21083 (1, 114). CAS 33339 (1, 61). NMP 1457 (1, 78.6). NMP 2346 (1, 129). NMP 5217 (2, 119–120). SU 39135 (1, 108). USNM 99786 (1, 118). USNM 218532 (1, 98.9). USNM 218533 (1, 136). UWCF 7215 (3, 76.3–138).

Australia: WAM P.4981 (1, 150), P.4989 (1, 55.0), and P.4994 (1, 118), all paratypes of *I. cirrhosus*, Shark Bay, Western Australia.

DIAGNOSIS.—No filamentous pectoral fin rays in adults. Orbits only slightly elevated. Snout length equal to or longer than postorbital distance (postorbital distance into snout 1.0–1.5). Interspinous membrane from fourth dorsal spine rearwards less than one-fourth spine height. Coloration of inner surface of pectoral fin variable (Figs. 1e–f), but always with some large pale spots.

DESCRIPTION.—Dorsal fin with 17–18 spines and 7–9 (usually 8–9) soft rays, total 25–26. Anal fin with 2 spines and 11–13 (usually 12) soft rays. Gill rakers on outside of first arch total 7–10, 2–3 on upper arch, 5–8 on lower arch. Vertebrae 28 (1 specimen) or 29 (5). Head spines and general body features as for the genus. Upper pectoral fin rays ending in filaments in juveniles (Fig. 1f) but not filamentous in adults.

Color in life, according to McKay (1963:9) for Australian specimens: "Pectoral fin dark brown, almost black with indistinct pale cross-bars and variable blotches on outer surface. Inner surface dark brown to blackish, with 20 to 35 white (in

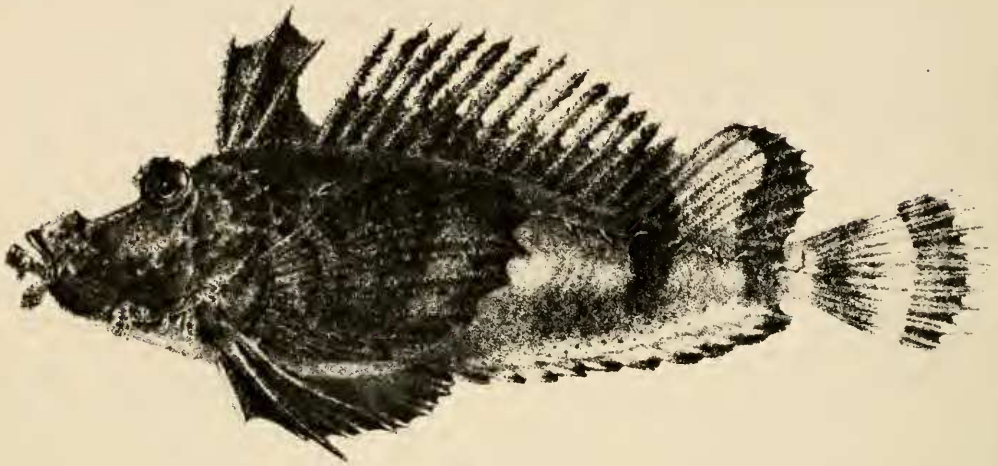


FIGURE 4. *Inimicus caledonicus*, ZSI 1749, 101 mm SL (from Day 1875, pl. xxxix, fig. 1).

life bright yellow) spots of indefinite shape. In larger examples the yellow spots are more diffuse and frequently in the form of ocelli." Rama-Rao and Badrudeen (1973:420) provide the following for a specimen from India: "Colour in life: Body blackish with orange blotches; ocelli on the inner surface of pectoral fin and spots on caudal fin with yellowish tinge in middle and reddish orange around; pelvic fin blackish."

General body shape and coloration of preserved specimens as in Figure 3c. Body and head dark brown to tan or gray, paler below. Sometimes body almost uniform in color, but usually mottled with paler areas; some dark grayish specimens are strongly marked with white patches. Head often with minute dark spots, large pale spot before each eye in some specimens; body often with irregular small dark spots on a pale background or with pale areas if background is dark. Soft dorsal fin usually paler anteriorly. Caudal fin usually with a narrow pale area at base and a broad pale area at middle of fin, often as band of vague white spots, otherwise fin dark. Pelvic fin dark distally. Outer surface of pectoral fin variable, often reflecting white spots of inside. Inner surface of pectoral fin mostly dark with large white, somewhat irregular spots as in Figures 1e, f; sometimes small dark spots also present; large white spots variable in shape and in number, from 2 or 3 to more than 35; in largest specimens, white spots

may have a dark center; spots sometimes rather faint.

Measurements for twenty specimens (55.0–216 mm SL) in percent SL: head 33–40, snout 14–18, orbit 4–6, interorbital width 7–12, postorbital 13–17, pectoral fin 33–43.

COMPARISONS.—See *Inimicus cuvieri* (p. 487).

DISTRIBUTION.—*Inimicus sinensis* is known from India, Ceylon, Java, Viet Nam, Hong Kong, China, Philippines, and Western Australia. Depths of capture range from 5 to about 90 m, on sand bottom.

Inimicus caledonicus (Sauvage)

(Figures 1g & h, 4, 8; Table 1)

Pelor didactylum (not of Pallas): DAY 1875:160–161, pl. 39, fig. 1 (description; Andaman Is.). DAY 1889:72–73, fig. 31 (compiled from Day 1875).

Pelor caledonicum SAUVAGE, 1878:147–148, pl. II, fig. 6 (original description; type-locality New Caledonia). FOWLER 1928:299 (compiled from Sauvage 1878).

Pelor barbatus DE VIS, 1885:547 (original description; type locality Cape York, Australia). McCULLOCH 1916:96–97, pl. 58 (good description; Queensland localities; 9–33 fms [16–60 m]).

Inimicus barbatus: MCKAY 1964:10 (body proportions and inner pectoral fin coloration; compared with *I. didactylus*). MARSHALL 1965:431–432, pl. 58, fig. 418 (short synonymy; description; distribution).

Inimicus caledonicus: MCKAY 1964:10 (counts; compiled).

REMARKS.—We believe that the single specimen in MNHN 1518 is the holotype of *P. caledonicum*. It was not listed as a type by Blanc

and Hureau (1968), and it carried the specific name *sinensis* when it was made available to us. It agrees in locality, size, and in all features with the figure and description as given by Sauvage (1878) except that the membranes between the dorsal spines are illustrated as joining the spines for their entire length, a condition not found in any species of *Inimicus*.

The type of *I. barbatus* (QMB 112/374) and a second Australian specimen (SU 20555) closely resemble our specimens from New Caledonia, and we feel that *barbatus* is a synonym of *caledonicus*. We also refer the specimens (ZSI 1749–1750) reported from the Andaman Islands (Day 1875) and a specimen from the Nicobar Islands (ZSI 440/2) to *I. caledonicus*.

MATERIAL EXAMINED.—**New Caledonia:** MNHN 1518 (123, holotype of *P. caledonicum*), received from "Musée des Colonies." MNHN A2498 (2, 91.2–96.3). MNHN A2833 (1, about 130, dried). MNHN A4877 (2, 86.8–90.3).

Australia: QMB 112/374 (144, holotype of *P. barbatus*), Queensland, Cape York. ANSP 98707 (1, 110), Queensland. SU 20555 (1, 170), Queensland.

Andaman Is.: ZSI F1749–1750 (2, 55.0–101) purchased from F. Day [specimen 1749 figured in Day 1875, pl. 39, fig. 1].

Nicobar Is.: ZSI F440/2 (1, 122).

DIAGNOSIS.—No filamentous pectoral rays in adults. Orbits only slightly elevated. Snout length greater than postorbital distance (postorbital distance into snout 1.2–1.4). Interspinous membranes from fourth spine rearwards low, extending up to about one-fifth of spine height. Inner surface of pectoral fin usually with two broad dark areas (Fig. 1g, h).

DESCRIPTION.—Dorsal fin with 17 spines and 8–9 (usually 8) soft rays, total 25–26. Anal fin with 2 spines and 11–12 soft rays. Gill rakers on outside of first arch total 10–12, 3 on upper arch, 7–9 on lower arch. Vertebrae 28 (2 specimens). Head spines and general features as for the genus.

Color in life, according to Day (1875:161) for specimens from the Andaman Islands: "brownish-grey becoming dirty white beneath, with fine spots over the body and head. Dorsal coloured as the body, a dark band passes down the last few spines on to the body, and another over the last few rays takes the same course; caudal yellow with a dark vertical band across its base, and another in its last third; outer edge of anal dark coloured." De Vis (1885:547) provides the following for a specimen from Australia: "Color brown, densely freckled with blackish brown. Soft dorsal with a pale blotch in the middle of

its anterior half, caudal with a broad pale band across the centre flecked with dark brown. Pectoral with a pale central band becoming more distinct towards its upper edge. A white spot in front of each orbit." Preserved specimens about as in Figure 4. Darkest below front, middle, and end of spinous dorsal fin; color extending onto fins. Soft dorsal fin darkest distally. Caudal fin streaked with brown, darkest just beyond middle, also a dark patch near base. Inside of pectoral fin as in Figure 1g, h; two dark areas, with streaks of darker brown in some specimens; inside nearly uniform dark brown in one [discolored?] specimen (ANSP 98707). Coloration on inner surface of pectoral fin shows through from outside of fin.

Measurements for seven specimens (86.8–170 mm SL) in percent SL: head 34–36, snout 15–17, orbit 6–7, interorbital width 7–9, postorbital 12–14, pectoral fin 38–48.

DISTRIBUTION.—*Inimicus caledonicus* is known from New Caledonia, Queensland coast of Australia, and the Andaman and Nicobar islands in about 15 to 60 m. A wider distribution is expected.

Inimicus didactylus (Pallas)

(Figures 1i–l, 5, 8–10; Table 1)

Scorpaena didactyla PALLAS, 1769:26–29, pl. 4, figs. 1–3 (original description; no type-locality). SHAW 1803:279–280 (compiled).

Trigla rubicunda HORNSTEDT, 1788:49–51, pl. 3 (original description; type-locality Amboina; figure poor).

Synanceia didactyla: BLOCH AND SCHNEIDER 1801:195–196 (compiled description and distribution).

Synanceia rubicunda: BLOCH AND SCHNEIDER 1801:196 (compiled).

Pelorus maculatum CUVIER in CUVIER AND VALENCIENNES, 1829:434–435 (original description; type-locality Waigiou). LESSON 1830:210, pl. 20 (Waigiou). CUVIER 1834:27, fig. 2 (figure poor). BLEEKER 1849:3–4 (listed; Waigioe); 1851:20, 22 (listed; Waigioe); 1852b:242 (listed; Waigioe). GÜNTHER 1860:150 (compiled from Cuvier 1829). BLEEKER 1873:141 (listed; Amoy, China). PETERS 1876b:834 (listed; New Britain). BLANC AND HUREAU 1968:27 (type at MNHN).

Pelorus obscurum CUVIER in CUVIER AND VALENCIENNES, 1829:436–437 (original description; type-locality Port Praslin, New Ireland). LESSON 1830:211, pl. 21, fig. 2 (New Ireland). BLEEKER 1854b:360 (listed; Batjan). SAUVAGE 1878:148 (compared with *P. caledonicum*). BLANC AND HUREAU 1968:28 (type at MNHN).

Scorpaena digitata GRAY, 1854:117–118 (original description; type-locality "Indian seas").

Pelorus didactylum: GÜNTHER 1860:150 (compiled; brief description; synonymy). SAUVAGE 1878:147 (compared with *P. caledonicum*). SEALE 1906:83 (listed; one specimen from Fate, New Hebrides; BPBM 963). PELLEGRIN 1912:206 (Port Sandwich, New Hebrides). WEBER 1913:497–498 (syn-

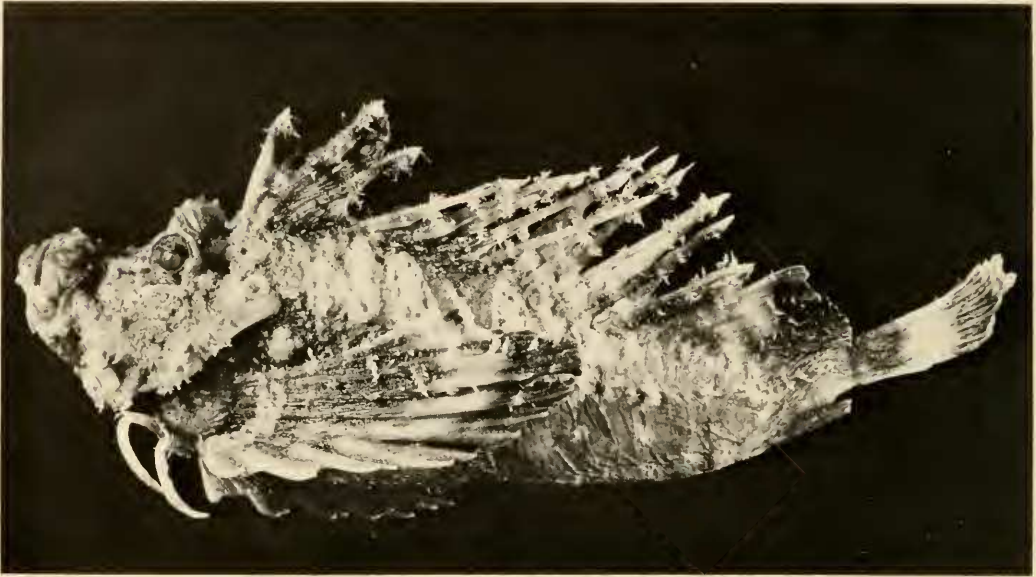


FIGURE 5. *Inimicus didactylus*, WAM P5801, 113 mm SL, New Hebrides.

onymy; one specimen from SIBOGA sta. 258, Kei Is., in 22 m). FOWLER 1928:298–299 (synonymy; description; one specimen from Fate, New Hebrides). HERRE 1931:13 (listed; New Hebrides). FOWLER 1938:201 (brief synonymy; Singapore).

Pelor didactylus: BLEEKER 1861:49 (listed; Singapore); 1873:141 (listed; China); 1874:4, 7–8, pl. 4, figs. 1–1a (description; good figures; synonymy; [p. 22, list of figures in error]).

Simopias didactylus: GILL 1905:221 (*Synanceja didactyla* and *S. rubicunda* as treated by Bloch and Schneider as synonyms of *Simopias didactylus*).

Inimicus didactylum: FOWLER 1918:65 (listed; new record for Philippines).

Inimicus didactylus: FOWLER 1927:288–289 (description; one specimen from Philippines). HERRE 1934:66 (nine specimens from the Philippines; smallest one with 17 dorsal spines). MATSUBARA 1943:418–420, fig. 143 (synonymy; detailed description based on a specimen from Pelew I.). DE BEAUFORT in WEBER AND DE BEAUFORT 1962:104–106, fig. 30 (synonymy; good description; distribution). MCKAY 1964:10 (compared with *Inimicus barbatus* and *I. cirrhosus*). TORTONESE 1964:79 (listed; two specimens from Korido, New Guinea).

Inimicus bifilis FOWLER, 1938a:85–86, fig. 38 (original description; type-locality Canmahala Bay, Philippines, ALBATROSS). MCKAY 1964:11 (suggested *I. bifilis* might be a juvenile of *I. didactylus* or *I. cuvieri*).

REMARKS.—The nominal species *Trigla rubicunda* Hornstedt, *Pelor maculatum* Cuvier, *Pelor obscurum* Cuvier, and *Scorpaena digitata* Gray all have been previously referred to *didactylus*. McKay (1964) suggested that *I. bifilis* was a juvenile of *I. didactylus* or *I. cuvieri*; our ex-

amination of the specimen shows that it is a juvenile of *I. didactylus*.

MATERIAL EXAMINED.—RMNH 669 (104, holotype of *Scorpaena didactyla*), no specific locality given.

Thailand: CAS 15165 (1, 136).

Singapore: CAS 15159 (1, 110). NMS 208 (1, 107).

South Viet Nam: CAS 15166 (1, 94.3).

Indonesia: ZMA 101.829 (1, 102), Java Sea. ZMA 101.900 (1, 84.9), Kei Is. ZMA 109.799 (1, 43.7), Kei Is.

Philippines: USNM 98905 (40.7, holotype of *Inimicus bifilis*), Canmahala Bay, ALBATROSS, 11 Mar. 1909. CAS 15164 (1, 84.6). NMP 2042 (1, 90.5). NMP 5218 (1, 101). SU 28360 (4, 46.6–116). SU 28361 (2, 111–120). SU 29785 (1, 88.1). USNM 168173 (1, 29.4). USNM 136457 (1, 80.6). USNM 136458 (1, 79.8). USNM 136459 (1, 33.9). USNM 136460 (1, 44.8).

Northern Australia: CAS 31426 (1, 41.5), Timor Sea.

New Guinea: MNHN 6726 (130, holotype of *Pelor maculatum*), Waigiou, Lesson and Garnot. MNHN 718 (1, 87.3). MNHN 6734 (1, 112). MNHN 6735 (1, 81.0). USNM 218504 (1, 132). USNM 218535 (1, 61.0).

Palau Is.: CAS 15160 (3, 120–149). CAS 15161 (1, 116). CAS 15162 (1, 117). CAS 15163 (2, 97.7–136).

Bismark Archipelago: MNHN 6725 (125, holotype of *Pelor obscurum*), New Ireland, Lesson and Garnot. MCZ 25150 (1, 144), New Britain.

Solomon Islands: USNM 144298 (1, 88.2).

New Hebrides: BPBM 963 (1, 103). MNHN 94–364 (1, 120). WAM P5801 (1, 113).

DIAGNOSIS.—No filamentous pectoral rays in adults. Orbits moderately far apart, not highly elevated. Snout longer than postorbital distance (postorbital distance into snout 1.2–1.7). In-

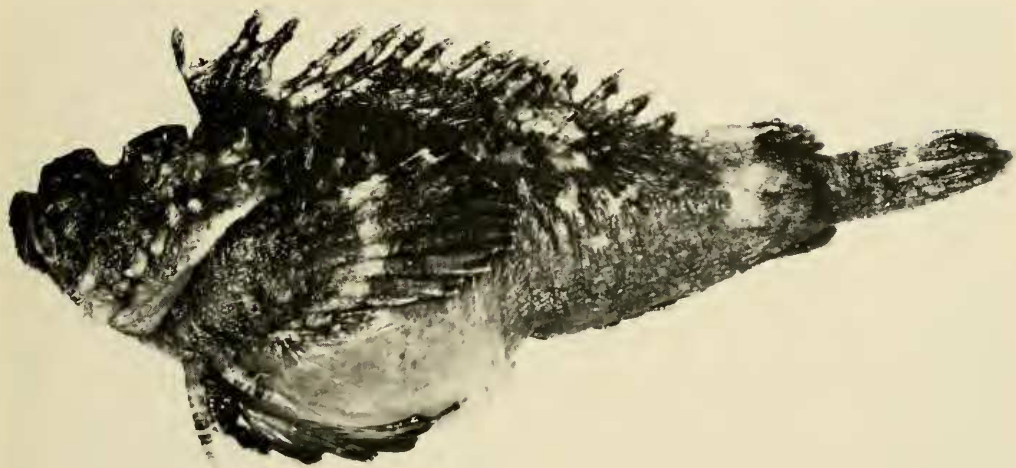


FIGURE 6. *Inimicus brachyrhynchus*, CAS 31424, 109 mm SL, Hong Kong.

terspinous membranes from fourth dorsal spine rearwards less than one-third of spine height. Inner pectoral fin coloration (Figs. 1i–l) diagnostic.

DESCRIPTION.—Dorsal fin with 15–17 (usually 16) spines and 7–9 (usually 8 or 9) soft rays, total 23–26 (usually 24 or 25). Anal fin with 2 spines and 10–12 (usually 11) soft rays, total usually 13. Upper 1 or 2 pectoral rays filamentous in juveniles under about 50 mm SL (to 46.3 mm SL in our material). Gill rakers on outside of first arch total 9–11, 1–3 on upper arch, 7–9 on lower arch. Vertebrae 28 (5 specimens). Head spines and general features as for genus.

General body shape and coloration of preserved specimens as in Figure 5. In preservative, body and head brown mottled with paler areas, variable. Underparts tan with darker irregular spots or tan with pale spots. White spots in area before eyes and in occiput not well marked. Interspinous membrane of spinous dorsal dark brown, especially between spines 1–3. Soft dorsal fin pale in middle. Caudal fin with dark band near base and a broad subterminal band. Anal fin mostly dark. Pelvic fins dark brown to blackish, usually streaked with white near base. Pectoral fin usually with a pale area at base, followed by large dark area, a pale band, then dark distally. Inner surface of pectoral fin distinctive (Figs. 1i–l); streaks of white sometimes as roundish pale patches.

Measurements for 32 specimens (43.7–148 mm SL) in percent SL: head 32–37, snout 15–20, orbit 5–6, interorbital width 5–11, postorbital 10–15, pectoral fin 39–48.

DISTRIBUTION.—*Inimicus didactylus* occurs from the Indo-Australian Archipelago to the Philippines, Micronesia, and Melanesia.

Inimicus brachyrhynchus (Bleeker)

(Figures 1m, 6, 8; Table 1)

Pelor brachyrhynchus BLEEKER, 1874a:4–7, pl. 2, fig. 4 and pl. 3, fig. 2 (original description; type-locality Singapore; fairly good figure). BLEEKER 1878:fig. 1 on pl. 413 (figure from Bleeker 1874; [fig. 1d of pectoral fin labeled as *P. brachyrhynchus* is *P. cuvieri*]).

Pelor cuvieri: BLEEKER 1878:pl. 416, fig. 3a ([switched fig. 1a on pl. 413 with fig. 3a on pl. 416]; from Bleeker 1874).

Inimicus brachyrhynchus: DE BEAUFORT in WEBER AND DE BEAUFORT 1962:105–107 (description of holotype and one additional specimen with no data). MCKAY 1964:10 (comparison with *I. cirrhosus*).

MATERIAL EXAMINED.—RMNH 5907 (130, holotype of *I. brachyrhynchus*), Singapore, P. Bleeker. CAS 31424 (1, 109), Hong Kong.

DIAGNOSIS (based on two specimens).—No filamentous pectoral rays in adults. Orbits only slightly elevated. Snout shorter than postorbital distance (postorbital distance into snout 0.7–0.8). Interspinous membranes from fourth dorsal spine rearwards extend up to about one-half of spine height. Inner pectoral fin coloration diagnostic (Fig. 1m).

DESCRIPTION.—Dorsal fin with 17 spines and

8 branched soft rays, total 25. Anal fin with 2 spines and 10 soft rays, total 12. Gill rakers on outside of first arch total 11–13, 3 on upper arch, 8–10 on lower arch. Vertebrae 29 (1 specimen). Head spines and general features as for the genus.

General body shape and coloration of preserved specimens as in Figure 6. Head and body mostly dark brownish, with belly paler. Interspinous membrane with white patches between about spines 3–5 and 13–17; pale areas extending on to body. Slightly oblique pale patch along anterior part of soft dorsal fin extending about half way down body. Caudal fin with pale areas. Inner surface of pectoral fin as in Figure 1m. A transverse white band at about middle of pectoral fin as seen from outer surface. On inner surface band made up of large white spots.

Measurements for 2 specimens (109 and 130 mm SL) in percent SL: head 33–35, snout 12–13, orbit 5, interorbital width 9–10, postorbital 16–17, pectoral fin 32–35.

DISTRIBUTION.—*Inimicus brachyrhynchus* is known only from two localities, Singapore and Hong Kong. A wider distribution is expected.

Inimicus joubini (Chevey)

(Figure 1n, 7a, 8; Table 1)

Chorismopelorus joubini CHEVEY, 1927:222–224, fig. (original description; type-locality Tonkin Gulf, Haiphong, figure poor; comparisons with other genera; as type of genus *Chorismopelorus*).

Chorismopelorus joubini: BLANC AND HUREAU 1968:26 (type at MNHN).

REMARKS.—Chevey distinguished this species from those of the genus *Inimicus* principally on the basis of its having three instead of two free lower pectoral rays. The third ray from the bottom is free distally, more so than in the other species of *Inimicus*, but the third ray is much more closely joined to the rays above than to the lower two free rays (Fig. 1n). In all other features *joubini* seems to be closely related to species of the genus *Inimicus*, particularly the *japonicus* subgroup, and we do not feel this small difference is of either generic or subgeneric importance. We have located only one additional specimen that we feel is *I. joubini*, although its third pectoral ray from the bottom is free for only about one-sixth of its length.

MATERIAL EXAMINED.—MNHN 26.398 (158, holotype of *C. joubini*), Haiphong, Tonkin Gulf, North Vietnam. P. Chevey. SU 67600 (1, 111), Hiroshima, Japan. D. S. Jordan and J. O. Snyder.

DIAGNOSIS (based on two specimens).—No filamentous pectoral rays in adults. Third pectoral ray from the bottom free for about one-third its length as in Figure 1n. Orbits slightly elevated. Snout shorter than or nearly equal to postorbital distance (postorbital distance into snout 0.7–0.9). Interspinous membranes from fourth dorsal spine rearwards extend up to one-half spine height. Inner pectoral fin coloration (Fig. 1n) mostly plain colored, not strikingly marked.

DESCRIPTION.—Dorsal fin with 17 spines and 7 soft rays, total 24. Anal fin with 2 spines and 8–9 soft rays, total 10–11. Lower two pectoral rays free; third ray from bottom free for part of its length (about one-third its length in type and one-sixth in second specimen). Gill rakers on outside of first arch total 9, 2–3 on upper arch, 6–7 on lower arch. Vertebrae 28 (2 specimens). Head spines and general features as for genus.

General body shape and coloration of preserved specimens as in Figure 7a. Color of holotype blackish brown with dark spots and markings over body and head. White patches between dorsal spines 3–4 and 8–11, pale areas extending on to body. Fins with variegated pattern. Second specimen light colored (Fig. 7a). Inner pectoral coloration as in Figure 1n; background pale with light and dark patches similar to that of *I. japonicus*.

Measurements for 2 specimens (110–158 mm SL) in percent SL: head 35–36, snout 13–15, orbit 5–6, interorbital width 8–10, postorbital 15–18, pectoral fin 37–42.

COMPARISONS.—*Inimicus joubini* is very similar to *I. japonicus* in most features, including counts and shape. The coloration on the inner surface of the pectoral fin also is similar. *Inimicus joubini* appears to have the area at the front of the dorsal fin slightly more elevated than in *I. japonicus*. In nearly all of our specimens of *I. japonicus*, the third ray from the bottom is fully joined to the ray above, with the membrane extending all the way to the tip; in a few specimens the tip is barely free. In *I. joubini* the third ray from the bottom is free for part of its length as discussed above. *Inimicus brachyrhynchus*, the third species in this species group as discussed under the genus, can be separated on the basis of pectoral fin coloration as given in the key.

DISTRIBUTION.—*Inimicus joubini* is known from the holotype from the Tonkin Gulf, North

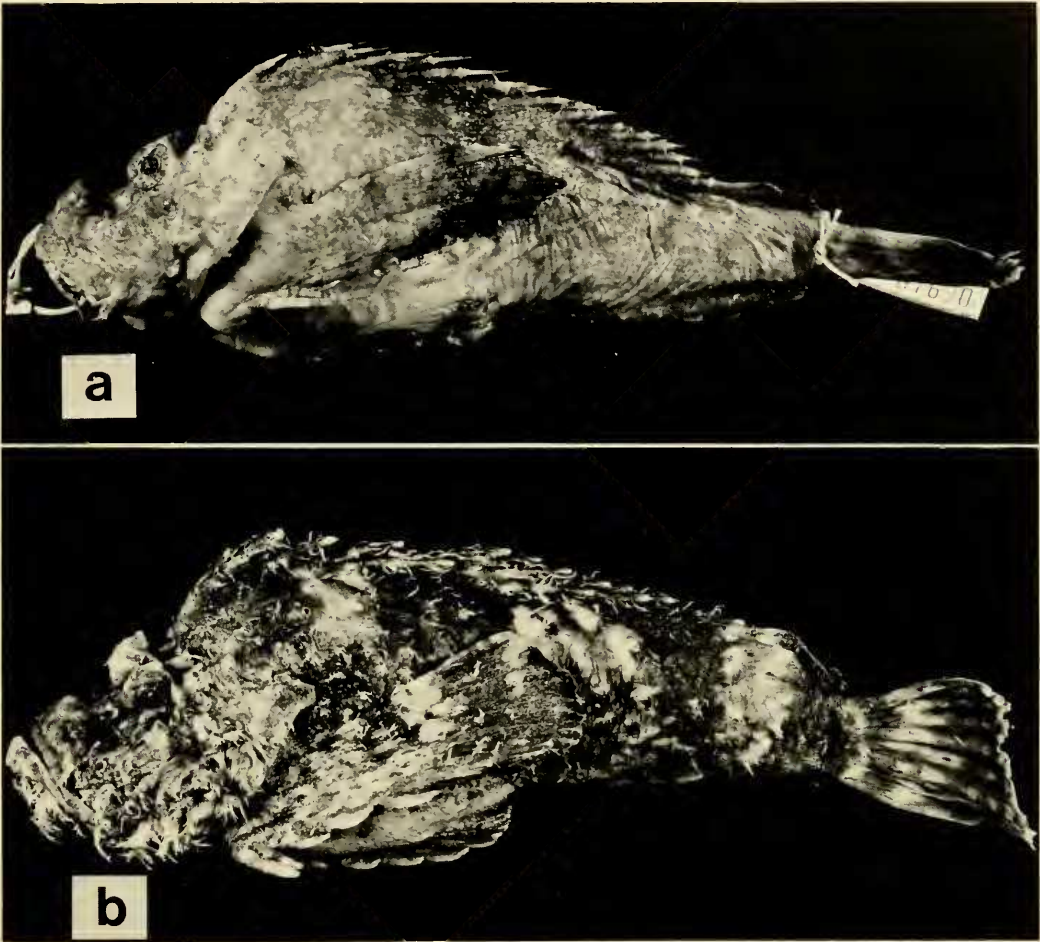


FIGURE 7. (a) *Inimicus joubini*, SU 67600, 111 mm SL, Hiroshima, Japan; (b) *I. japonicus*, UT 51839, 190 mm, Japan.

Viet Nam, and from another specimen from Japan.

***Inimicus japonicus* (Cuvier)**

(Figures 1o, 7b, 8; Table 1)

Pelor japonicum CUVIER in CUVIER AND VALENCIENNES, 1829:437, pl. 93 (original description; type-locality Japan). TEMMINCK AND SCHLEGEL 1843:44, pl. 18, fig. 2 (description; Nagasaki, Japan). RICHARDSON 1846:212 (short description; distribution, Japan and China). GÜNTHER 1860:151 (*Pelor tigrinum* in synonymy; short description; China and Japan). STEINDACHNER AND DÖDERLEIN 1884:197 (*Pelor auranticum* in synonymy; compared with *P. japonicum*; Tokyo). NYSTRÖM 1887:19 (listed; Nagasaki, Japan). STEINDACHNER 1896:203 (short description; Kobe, Japan). ISHIKAWA AND MATSUÛRA 1897:49 (listed, Japan). JORDAN AND SNYDER 1901a:367 (listed; Tokyo). JORDAN AND SNYDER 1901b:100 (listed; Yokohama, Nagasaki, and Shimoda, Japan).

Pelor auranticum SCHLEGEL in TEMMINCK AND SCHLEGEL, 1843:44, pl. 18, fig. 1 (original description; Nagasaki, Japan). RICHARDSON 1846:212 (listed; Japan). GÜNTHER 1860:151 (compiled from Schlegel 1843). JORDAN AND SNYDER 1901b:100 (listed; Nagasaki and Kaminoseki, Japan). *Pelor tigrinum* RICHARDSON, 1846:212 (original description; type-locality Canton, China). *Inimicus auranticus*: JORDAN AND STARKS 1904:160 (key; description; Hiroshima and Kobe, Japan). *Inimicus japonicus*: JORDAN AND STARKS 1904:159 (key; description, southern Japan). FRANZ 1910:74 (listed; Sagami-bai and Aburatsubo, Japan). JORDAN AND METZ 1913:52 (listed; Fusan, Korea). JORDAN, TANAKA, AND SNYDER 1913:249 (listed; *Pelor auranticum* included as a possible synonym; Tokyo to Nagasaki, Japan). JORDAN AND THOMPSON 1914:276 (listed; Misaki, Japan). JORDAN AND HUBBS 1925:275 (listed many Japanese localities; common in the Japanese markets southwards). MORI 1928:7 (listed; Oni-okoze and Ruganho, Japan). SCHMIDT AND LINDBERG 1930:1146 (listed; Tsuruga Bay, Japan). SCHMIDT 1931a:111

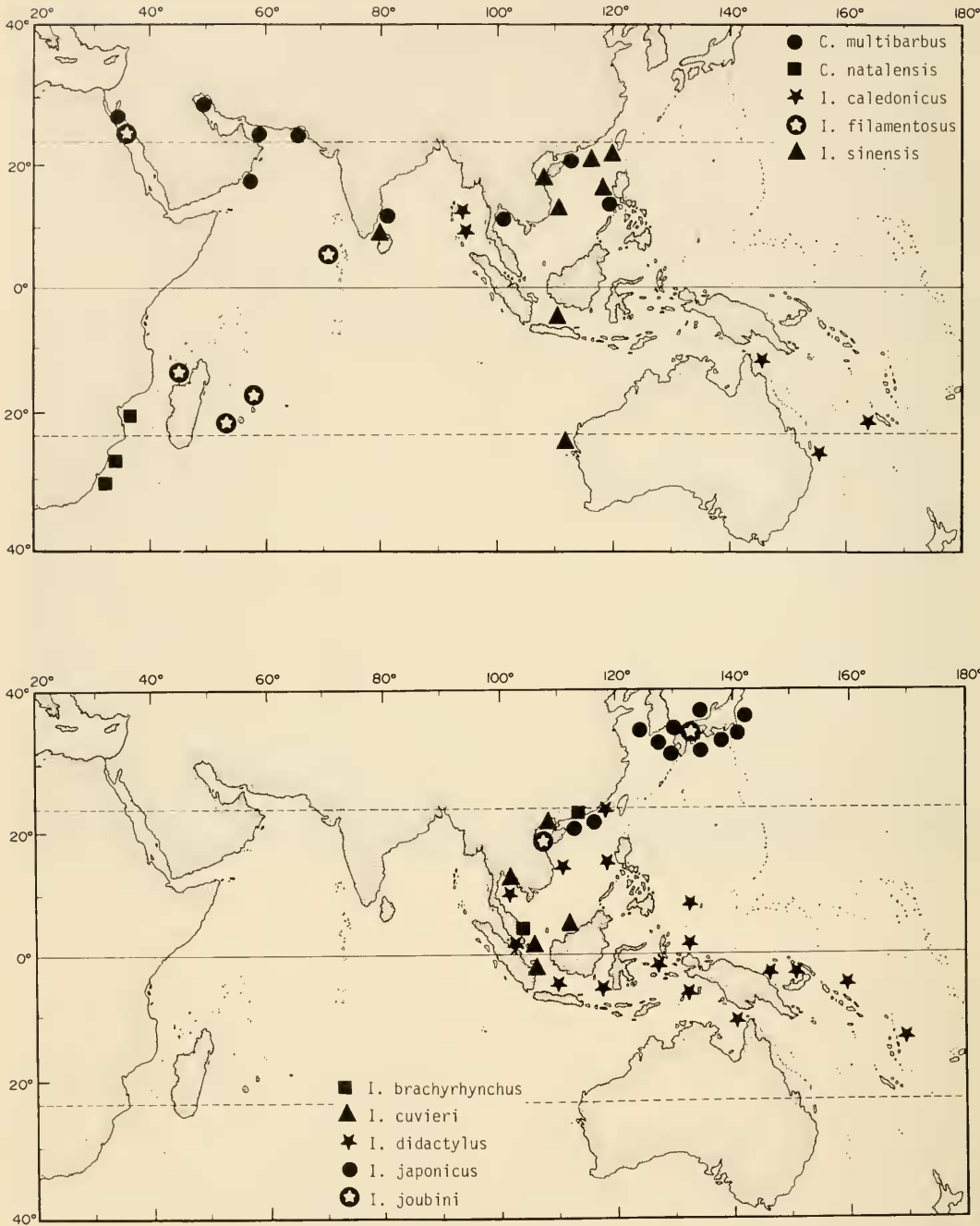


FIGURE 8. Distribution of the species of the genera *Choridactylus* and *Inimicus*.

(listed; Nagasaki and Misaki, Japan and Fusan, Korea); 1931b:116 (listed; Nagasaki and Obama, Japan). TANAKA 1931:36 (listed; Japan). KAMOHARA 1938:49 (listed; Okoze, Japan). TORTONESE 1939:361-362 (description; color variation; Yokohama, Japan). MATSUBARA 1943:415-418 (syn-

onymy; good description; internal features; Japanese specimens; distribution). MORI 1952:156 (listed; Pusan, Quelpart I., South Korea, and Yongampo, Japan). MOON KI 1956:27 (listed; southern Japan). MORI 1956:27 (listed; southern Japan).

Inimicus japonicus var. *auranticus* FRANZ, 1910:74 (description of three color varieties in Japan).
Scorpaenopsis cirrhosa: HALSTEAD 1970:pl. XXVIII (3 color phases).

MATERIAL EXAMINED.—**Hong Kong:** CAS 27953 (1, 162) FRSHK uncat. (1, 145). MCZ 13977 (2, 184–186). SU 29256 (1, 212). SU 60958 (1, 180).

China: CAS 868 (1, 100). MCZ 13975 (1, 103). USNM 130535 (1, 174). USNM 130596 (2, 155–178).

Korea: CAS 15769 (2, 139–191). CAS 31926 (1, 126). MCZ 47707 (2, 48.5–189). SU 25279 (1, 140).

Japan: RMNH 597 (235, stuffed specimen, lectotype of *Pelor aurancticum*), Burger collection. RMNH 614 (166, paralectotype of *auranticum*), Von Siebold collection. CAS 11245 (1, 143). CAS 31435 (1, 136). CAS 31436 (1, 158). CAS 31434 (1, 155). CAS 31433 (1, 129). SU 3698 (2, 79.1–168). SU 7170 (1, 217). SU 7179 (1, 176). SU 7417 (1, 204). SU 7851 (2, 81.1–162). SU 23560 (2, 200–206). UT 51839 (1, 190). Additional material is present in the USNM.

DIAGNOSIS.—No filamentous pectoral rays in adults. Orbits somewhat elevated. Snout shorter than postorbital distance (postorbital distance into snout 0.7–0.9). Interspinous membrane from fourth dorsal spine rearwards extends up to one-half of spine height. Inner pectoral fin coloration variable (usually as in Fig. 1o), with no diagnostic pattern.

DESCRIPTION.—Dorsal fin with 16–18 (usually 17) spines and 5–8 (usually 7) soft rays, total 23–25 (usually 24). Anal fin with 2 spines and 9–10, rarely 8 soft rays, total 10–12. Upper pectoral ray filamentous in 48.5-mm-SL specimen; not filamentous in larger specimens. Gill rakers on outside of first arch total 10–12, 2–4 on upper arch, 7–9 on lower arch. Vertebrae 28 (2 specimens) and 29 (1). Head spines and general body features as for the genus. Body with many skin appendages, particularly on head, and on dorsal and pectoral fins.

General body shape and coloration of preserved specimens as in Figure 7b. In general, color of body highly variable. Head and body mostly brown, underparts paler; body often light colored except for dark spots on underparts. Head with variable dark patches. Broad pale patches often present between dorsal spines 3–5, 11–14, and beginning of soft dorsal, pale areas extending along the lateral side of body. Fins variously blotched with paler color on dark background. Pectoral and caudal fins with white and brown bands. Inner surface of pectoral fin as in Figure 1o, variable, without a conspicuous pattern, most often streaked or spotted brown; in some dark gray to light brownish, with black spots or patches.

Color in life variegated, often reddish or brown mottled with white. Sometimes mostly yellow with dark spots (“*auranticus*” pattern) [see Halstead 1970:pl. LX for three color variations].

Measurements for 28 specimens (75.3–217 mm SL) in percent SL: head 29–44, snout 12–15, orbit 4–6, interorbital width 8–11, postorbital 16–19, pectoral fin 35–46.

DISTRIBUTION.—*Inimicus japonicus* is an Oriental species occurring from southern Japan to Hong Kong.

DISTRIBUTION AND REMARKS ON BIOLOGY

Members of the subfamily Choridactylinae occur in the Indo-West Pacific (Fig. 8), from Japan southward throughout the Indo-Australian Archipelago to New Caledonia and Australia, and westward to the western Indian Ocean and Red Sea. Most species have fairly limited ranges. Members of this subfamily are not found in the central Pacific and represent another example of a group that seemingly could, but does not cross the Andesite Line marking the separation of continental and oceanic rocks (see Springer and Goman 1975:16). They occur on open sand or silty substrate (McKay 1964). Depths of capture range from near shore (about 5 m) to about 90 m, with most species found shallower than about 40 m.

Little is known about the biology of these fishes. They appear to be opportunistic predators feeding mostly on other fishes. They have venomous fin spines and erect the dorsal spines when aroused, as do many other scorpionfishes. They also have bright colors on the inner surface of the pectoral fin (see Condé 1977), and the fins are spread outward and rolled forward when the fish is aroused, thereby creating a flash of bright color from an otherwise drab individual; presumably this startles would-be predators. This behavioral response appears in some other scorpionfishes, occurring in such subfamilies as the Scorpaeninae and probably the Minoinae, and perhaps other subgroups. It is unknown whether this behavioral response is used in interspecific interactions.

Morphologically, a number of interrelated modifications and trends in the subfamily are directed towards settling into the substrate, concealment, and feeding behavior:

1. The lowermost two (*Inimicus*) or three

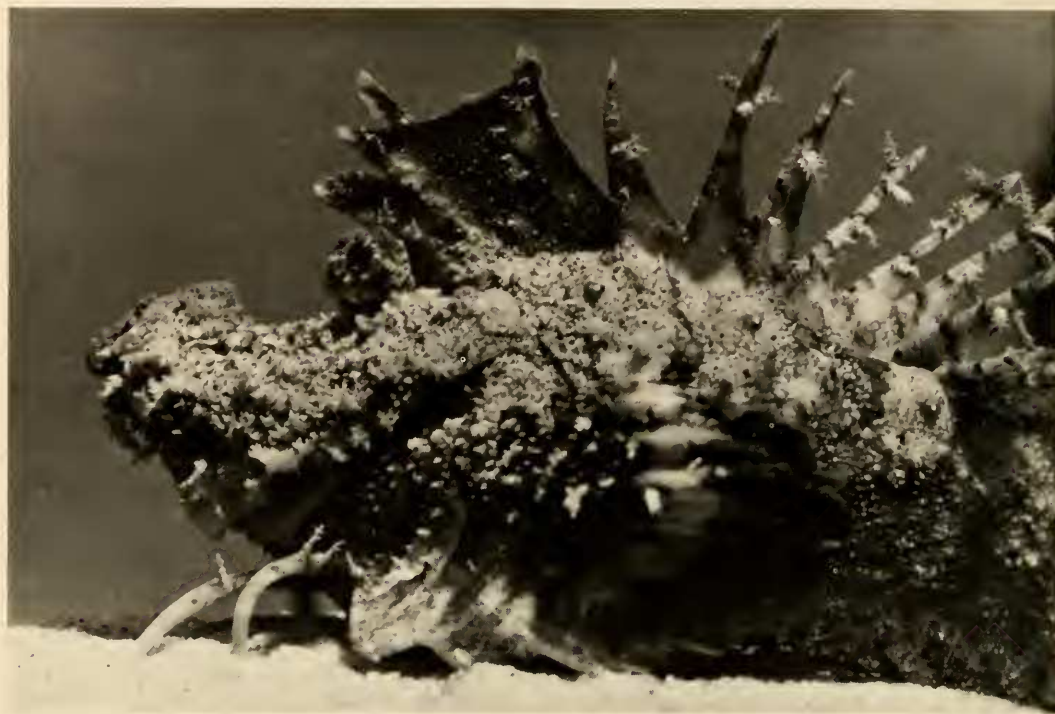


FIGURE 9. Live adult *Inimicus didactylus* in prowling posture. Note position of two free lower pectoral fin rays, location of eye, and anterior dorsal spines. (Photo by Tom McHugh in Steinhart Aquarium.)

(*Choridactylus*) pectoral fin rays are free of membrane (see Fig. 9). The free rays are used in "walking" on the bottom. The osteology of the pectoral girdle has been described by Samuel (1961).

2. The gas bladder is lost, but a drumming muscle remains (see Hallacher 1974:73).

In the genus *Inimicus*, the following additional modifications are found:

1. The eyes become situated high up on the head, well above the dorsal profile in the more specialized species (see Fig. 9). This would appear to permit deeper burying in the substrate.

2. The membranes of the dorsal fin, from the fourth spine rearward, become deeply incised. This is most advanced in species such as *I. filamentosus* (see Condé 1977; fig. 4) and *I. didactylus* (figs. 9–10). This reduction in membrane allows the spines to be folded laterally (see fig. 10). Skin flaps on the spines contribute to concealment.

3. The anterior three dorsal spines form an

apparent lure, reminiscent of that found in *Iracundus signifer* (see Shallenberger and Madden 1973), but our aquarium observations of *I. didactylus* indicate that the lure is stationary and not moved as in *Iracundus*.

4. The mouth is more upturned in more advanced species of *Inimicus*, presumably allowing deeper settlement in the substrate.

As observed for *I. didactylus* in Steinhart Aquarium, settling into the sand is accomplished by a rocking of the body and pushing of sand from underneath the body by the large pelvic fins. The lowermost two free pectoral rays are extended forward (Fig. 9), and they are used to pull the body out of the substrate when striking prey. Figure 9 shows the posture just before feeding. Engulfment of prey is extremely rapid. *Inimicus didactylus* was observed to walk on the bottom of its free pectoral rays while "stalking" prey and moving around the tank. Additional observations are provided by Condé (1977) for *I. filamentosus*.



FIGURE 10. Partially buried live adult *Inimicus didactylus*. (Photo by Tom McHugh in Steinhart Aquarium.)

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